# The implementation of integrated remediation with conceptual interactive learning on momentum and impulse in senior high school

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# The implementation of integrated remediation with conceptual interactive learning on momentum and impulse in senior high school

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**Abstract**. The study examines the effect of integrated remediation on momentum and impulse with conceptual interactive instruction to decrease the number of student misconception on Senior High School. The research employed the experimental method using pre-experimental design with one group pretest-posttest design and was conducted at SMAN 7 Pontianak involving 35 students of class X MIA taken by the intact group through random sampling technique. A diagnostic test which consists of 18 multiple choice questions. The misconception decrease was analyzed for significance by using McNemar test and DQM (The decreasing Quantity of the student that Misconception). The result shows that the integrated remediation of misconception on physics learning has a positive effect on students' misconception.

## 1. Background

In school learning, there are still many students who misconception in the field of physics. Wandersee, Mintzes, and Novak (in Suparno) explains that of the 700 studies on the field of physics, there are 300 that deal with misconceptions in mechanics [1]. One of the materials in the field of mechanics is quite a lot for the misconception that is on the material dynamic fluid. Many studies have shown misconceptions in the matter of momentum and impulse among others [2-4].

Based on interviews with teachers of physics class X in SMAN 7 Pontianak known that the difficulties felt by students on the material momentum and impulse are mathematical equations that exist in the concept makes the alternative conception of students are not built properly. The process of cognitive change in learning focuses more on solving problems that match the many formulas that must be memorized. Whereas prior to following the process of physics learning formally at school, students already have initial knowledge about physical concepts that they can from experience in everyday life. From that knowledge formed the initial concept of students about physics. The initial concept they brought was sometimes not appropriate or contrary to the concept possessed by experts.

The results of observations conducted at SMAN 7 Pontianak also showed that on average 66.67% of the total students of Science Class XI program in the academic year 2016-2017 had not reached the minimum completeness criterion (KKM). Saprianti found that 67.2% of students have misconceptions on the concept of continuity equation, 62.7% of students have misconceptions on

the concept of Bernoulli equation and 67.5% students experience misconceptions on the concept of applying Bernoulli equations [2].

In the subject of physics, if one material misconception still occurs when students study the other material because every material in the subject of physics is interrelated. Therefore, although difficult, misconceptions must still be addressed so that students do not constantly experience misconceptions.

Permendikbud [5] on Curriculum 2013 explains that in the context of standardds-based education, competency-based curriculum and mastery learning process assessment and learning outcomes are parameters of achievement level of minimum competence. It suggests that students should change their misconceptions into correct concepts to improve learning outcomes so that the student's score can reach the standard minimum.

Some of the right tips are done to help students overcome misconceptions that are looking for a form of error that the student has, searching for the causes, and with that understanding determine the appropriate way [1]. One of the most common ways to reduce student misconception is by doing remediation. Remediation is a process to help students overcome learning difficulties, especially to overcome misconception [6]. However, based on interviews with teachers at SMA Negeri 7 Pontianak, it was found out that teachers only do some remediation in the form of re-learning and more often do remediation only by giving retest to students who do not reach the value of standard minimum because of limited time owned by the teacher when in school. The solution to solve this problem is to remediate misconceptions during the learning process or commonly known as remediation integration.

In addition, the process of learning physics so far only based on the book-oriented formula and calculations. Physics learning is only to prepare students for a general repetition or a test that results in physics learning merely memorizing the formula for the preparation of the exam [7]. Learning that only prioritizes this mathematical equation will not lead to a conceptual change after learning so that students will stick to their misconceptions. Therefore, to overcome misconception, besides the need to do remediation also needed a more interactive learning process and emphasize to concept to happen of conceptual change to the student. So in this research conducted remediation activities along with the learning process using an appropriate approach that is an interactive conceptual approach.

According to Mudjiarto [8], conceptually intended this approach prioritizes the understanding of concepts, while interactive intended in teaching and learning process is directed to occur active interaction between students. According to Savinainen and Scott [9], The interactive conceptual approach consists of four components that complement each other as follows: 1). Conceptual focus is that students are asked to develop concepts based on demonstrations or videos observed in accordance with what they understand to know early conceptions of students; 2). Classroom interactions are students doing the discussion in pairs to create a temporary hypothesis, as well as teachers, look for the cause of students experiencing misconceptions; 3). In the Research-based Materials, the component experiment is done as a basis for answering conceptual exercises that are questions of answers and test the hypotheses made by students. This conceptual exercise serves to overcome difficulties and misconceptions that students have, and 4). Use of texts that students are given text in a comic form as another source of information. At the end of the learning, students are asked to complete the mind map made by the teacher as the stages of confirmation of the student's concept changes.

The research in the form of integration of remedy of misconception in momentum and impulse learning using interactive conceptual approach in SMA Negeri 7 Pontianak was conducted based on the result of research conducted by Hermawati [10] which found that integration activities of remedy misconception in learning with cognitive conflict approach on effective pressure material to decrease misconception with value effectiveness of DQM equal to 71.28% with high category.In addition, research conducted by Tajudin [11] on remediation using an interactive conceptual

approach with effective refutation text to improve misconception of class XII students of SMA Negeri 1 Semparuk on business material with effect size ES = 1.67204 (pertained high).

## 2. Method

The research method used is experimental with Pre-Experimental Design (nondesign) research form with One Group Pretest-Posttest Design [12]. The population of this study are students of class XI IPA SMA Negeri 7 Pontianak academic year 2017/2018 who have not received learning about momentum and impulse 153 people. The sample in this study is all students of class XI IPA two which amounted to 35 people. Data collection techniques in this study is a measurement technique in the form of a written test (pre-test and post-test) in the form of multiple choice as much as 18 questions. The research instrument is in the form of Lesson Plan, Student Worksheet, learning text (Comics and Mind Map), and test questions validated by two lecturers of Physics Education FKIP Universitas Tanjungpura and one science teacher of SMA Negeri 7 Pontianak with validation results that the instrument used is valid with the average validity of multiple choice questions of 3.89 (high). Pursuant to result of the test of matter which done in SMA Negeri 7 Pontianak obtained information that level of reliability question of choice of double equal to 0.45 (medium)

Pre-test and post-test results were analyzed by finding the percentage of misconceptions per student and the percentage of student misconceptions on each indicator before and after the integration of remediation activity. In this research Mc Nemar test to determine whether there is a change in conceptual students after the integration of remedies misconception in learning momentum and impulse using the conceptual approach interactive. The effectiveness of the use of remediation integration in momentum and impulse learning uses interactive conceptual interfaces to decrease the misconceptions of students using DQM. The procedure in this research consists of three stages: 1) Preparation Phase, 2) Stage of research implementation, 3) final stage.

## 3. Result and Discussion

This research was conducted in SMA Negeri 7 Pontianak in grade XI IPA 2 semester one academic year 2017/2018 on dynamic fluid learning. There are five meetings in this study. The pre-test was conducted at the first meeting on 22 August 2017 using a multiple choice test with 18 reasons. It is to know the student's early conception. After the pre-test is completed, the implementation of momentum and impulse learning uses an interactive conceptual approach that integrates three misconception remediation activities (3 x 45 Minutes) on August 24, 2016, August 29, 2017, September 5, 2017.

Post-test was conducted at the last meeting on September 12, 2017. Furthermore, the students' answers on the pre-test and post-test were recapitulated so that the percentage decrease in the number of misconceptions for each student can be seen in table 1 below:

**Table 1.** Distribution of Student Misconception Decrease

| Number of Students | %No | %Nt | $\%\Delta N$ |
|---|---|---|---|
| 35 | 84.29 | 24.44 | 71.14 |

Most students experienced a decrease in the number of misconceptions after the integration of misconception remediation in the learning of momentum and impulse using an interactive conceptual approach with an average decrease in the percentage of misconceptions per student by 71.14%. The percentage decrease in the number of students who misconception on each indicator can be seen in Table 2.

**Table 2.** Recapitulation of Student Misconception Decrease for Each Indicator

| Indicator | Experiment Class | | |
|---|---|---|---|
| | $S_o$% | $S_t$% | $\Delta S$% |
| Indicator 1 | 60.95 | 8.57 | 85.94 |
| Indicator 2 | 93.33 | 24.76 | 73.47 |
| Indicator 3 | 79.05 | 42.86 | 45.78 |
| Indicator 4 | 93.33 | 24.76 | 61.76 |
| Indicator 5 | 98.10 | 18.10 | 81.55 |
| Indicator 6 | 77.14 | 15.24 | 80.25 |

The results of pre-test and post-test analysis found the percentage decrease in the number of students experiencing misconceptions on each of the biggest concepts that are in the indicator 1 of 85.94% and the percentage decrease in the number of students who misconception on each of the smallest concepts that is on indicator three amounting to 45.78%. Based on the results of pre-test found the average percentage of misconception owned by students that is equal to 84.29%, whereas from the post-test results known the average percentage of misconceptions owned by students that is equal to 24.44%. Furthermore, from the results of pre-test and post-test analysis, it is known that there is a decrease in the number of student misconceptions after the integration of misconception remediation activities in the learning of momentum and impulse using an interactive conceptual approach with the average percentage decrease student misconception equal to 71.14%. The highest percentage of students misconception at the time of pre-test is indicator 5 determines the position of the object when the fluid flow rate in the gap between two objects is enlarged with the misconception percentage of 98.10%. In this indicator, almost all students answer incorrectly and provide reasons that are inconsistent with scientific concepts.

In addition, changes in student misconceptions can be seen from the results of Mc Nemar test related to changes in student misconceptions can be seen in Table 3.

**Table 3.** Recapitulation of Significant Changes in Student Conception in Each Indicator

| Indicator | A | B | C | D | Mc Nemar Test | Information |
|---|---|---|---|---|---|---|
| | | | | | *chi-square* $(\chi^2)$ | |
| **Indicator 1** | 3 | 38 | 6 | 58 | 47.80 | Significant |
| **Indicator 2** | 3 | 4 | 23 | 75 | 64.62 | Significant |
| **Indicator 3** | 6 | 16 | 39 | 44 | 27.38 | Significant |
| **Indicator 4** | 0 | 3 | 39 | 63 | 61.02 | Significant |
| **Indicator 5** | 0 | 2 | 19 | 84 | 82.01 | Significant |
| **Indicator 6** | 1 | 23 | 17 | 64 | 59.14 | Significant |
| **Total** | 13 | 86 | 143 | 388 | 348.82 | Significant |

From the McNemar test results note that there is a significant conceptual change in the momentum and impulse after given integration activities of remediation misconception in learning momentum and impulse using the conceptual approach interactive. The expected change in this study is the change of students experiencing misconceptions to be not misconceptions. To determine the change of student conception is significant or insignificant after following remediation activities that are integrated into learning momentum and impulse using statistic approach is using McNemar test. Due to the expected frequency $E \geq 5$, it follows by the chi-square formula ($\chi^2$).

Based on the results of the calculation using Mc Nemar test known that there is a significant change of conception on all the concepts of momentum and impulse consisting of 6 indicators with the value of $\chi^2$ counts of (348.82) > $\chi_{table}^2$ (3.84) with df = 1 and $\alpha$ = 5%. These results indicate that there are significant student conceptual changes after following the momentum and impulse learning using an interactive conceptual approach that integrates remedial misconceptions.

Then the effectiveness of the integration activities of misconception remediation in learning momentum and impulse using the interactive conceptual approach can be seen in Table 4.

**Table 4.** The Calculation of the Effectiveness of Decreasing the Number of Student Misconceptions

| **The Number of Student Misconceptions** | | **Student Misconception Percentage** | | **DQM** | **Effectiveness Category** |
|---|---|---|---|---|---|
| **Pre-test** | **Post-test** | **Pre-test** | **Post-test** | | |
| 531 | 154 | 84.29 % | 24.44 % | 71.46% | Tinggi |

Based on Table 4 presented, the effectiveness of remedial integration of misconception in learning momentum and impulse using an interactive conceptual approach is 71.46% with high effectiveness category. In addition to causing a decrease in student misconceptions, the integration of misconception remedial activities in momentum and impulse learning using an interactive conceptual approach may also improve learning outcomes.

Overall, students better understand the material momentum and impulse well after following the learning activities using an interactive conceptual approach that integrates remedial activities of misconception in learning. Learning activities using an interactive conceptual approach allows for remediation activities to take place during the lesson. It is evidenced by the level of effectiveness that is high. Based on the results of the analysis using the price of DQM (Decreasing the Number (Quantity) of Students Misconception), obtained the average level of effectiveness of each concept of 71.46% which is high ($70 < DQM \leq 100$). These findings suggest that integration of misconceptions remediation in learning momentum and impulse using an interactive conceptual approach can decrease the percentage of students who misconception.

Based on the reflection of learning done by the researcher, when the students' learning is not only told the correct concept but in each component, the interactive conceptual approach directs the students actively to find the concept itself through experiments using PhET simulation and simple experiment. Besides the students are also required to actively find the correct concept of reading material in the form of comic given by the teacher. Then at the end of the student worksheet, there is a mind map that should be filled by the students as a conclusion that serves as a strengthening and confirmation stages changes in student conception. It is in line with constructivism learning theory; it requires learning that encourages students to be active (experimentation, problem-solving) to create more knowledge, reflect, discuss what they have done and how students' understanding changes [13].

This finding is also in line with previous research by Rahardhian [14] found that integrated remediation in effective learning to improve student misconceptions is due to misconceptions that occur at the time of learning will be immediately remedied at the same time with the effectiveness of each student's remediation activity of 0.82 (high) and the proportion of the mean decrease of misconception percentage is 82.74%.In addition, research conducted by Tajudin [11] on remediation using an interactive conceptual approach with effective refutation text to improve misconception of

class XII students of SMA Negeri 1 Semparuk on business material with effect size ES = 1.67204 (pertained high). Another study on the implications of multi-representation interactive conceptual approaches to improve scientific consistency and reduce the quantity of student misconceptions in terms of thermodynamics that has been done by Sriyansyah[15]shows that students' scientific consistency experienced an average increase of 39%, while the number of misconception students decreased the average varies in the range of 7% to 92%.

## 4. Conclusions and Suggestions

Based on the result of the research, it can be concluded that the integration of misconception remediation activity in momentum and impulse learning using interactive conceptual approach can change student misconception significantly and can improve student learning outcomes.

Suggestions that can be given from the research that has been conducted for further research are as follows: 1) The next research should be able to consider the control class as control; 2) It is recommended that teachers have prepared and checked whether the tools that students will use such as laptops can function during an investigation.

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